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To cite this version:

Obeid, Hassan  and Marguet, Steven and Hassoune, Bouchra 
and Mérian, Tiphaine  and Leonardi, Aurélie and Ferrero, Jean-
François and Welemane, Hélène  *Influence of aging on the
mechanical behavior of bonded assemblies*. (2020) In: MDA 2020 -
3rd International Conference on Materials design and applications, 5
November 2020 - 6 November 2020 (Porto, Portugal).

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Influence of aging on the mechanical behavior of bonded assemblies

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For automotive industry, the use of bonded assemblies is a promising solution in order to reduce the vehicle's weight, and thus to decrease the CO₂ emissions and energy consumption. To guarantee the safety of passengers, in particular in crash situations, the understanding of aging effects on the physico-chemical properties and on the mechanical behavior of these assemblies remains a key point. In literature, many authors have studied the influence of aging on the mechanical strength of adhesive assemblies under quasi-static loading while varying the aging conditions [1, 2].

In this work, a specific accelerated hygro-thermal aging experimental method is used to characterize three adhesives dedicated to crash applications: 3MTM Scotch-WeldTM 2216, Permabond Loctite ESP110 and DOW^R BetamateTM 1496V. This method allows the quick determination of the evolution of the glass temperature and of the water absorption during the aging process.

The evolution of the mechanical strength of single lap joint specimens is characterized before and throughout the aging process, under both quasi-static and dynamic conditions. For that purpose, the tests are performed on standard hydraulic testing machines and on a dedicated weight drop tower using different loading speeds from 2 m/s to 8 m/s [3]. The major observed tendencies of aging on mechanical behavior are discussed.

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